INTI INTERNATIONAL UNIVERSITY

Faculty of Engineering and Quantity Surveying

COMPARATIVE STUDY ON THE DESIGN OF PAD FOUNDATION BASED ON BS 8110, EN 1992 AND ACI 318

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SUPERVISOR'S DECLARATION

This project report entitled "COMPARATIVE STUDY ON THE DESIGN OF PAD FOUNDATION BASED ON BS 8110, EN 1992 AND ACI 318" is prepared and submitted by VICTOR KUMALA PUTRA (I14007059) as partial fulfilment of the requirement for the Bachelor of Engineering (HONS) in Civil Engineering, INTI International University.

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STUDENT'S DECLARATION

I hereby declare that the final year project is based on my original work except for quotations and citations, which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at INTI INTERNATIONAL UNIVERSITY or other institutions.

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ABSTRACT

This paper presents a comparative study of pad foundation design outcomes based on BS 8110, EN 1992 and ACI 318 by using design spreadsheets. This study compares the flexure, shear and punching shear performance, by considering axial load and biaxial moments. The study is focused on some critical input parameters: concrete cover, size of pad foundation and size of column based on a conventional building (residential and commercial). Pad foundation models have been developed by using Autodesk Robot Structural Analysis to verify the flexure and shear. The obtained results compared are leading to some conclusions. For bending performance, EC design requires less area of tensile reinforcement, followed by BS design and ACI design. For shear performance, ACI design results in the lowest shear stress, followed by EC design and BS design. For punching shear performance, EC design results in the lowest punching shear stress, followed by BS design and ACI design. For overall performance, EC design provides the most economical design, followed by BS design and ACI design.

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BS 8110:

γ_{mc}	:	partial safety factor of material
γ_c	:	partial safety factor of concrete
γ_s	:	partial safety factor of steel
f_{cu}	:	characteristic compressive cube strength of concrete
f_y	:	characteristic tensile strength of reinforcement
G_k	:	characteristic dead load
Q_k	:	characteristic live load
W	:	design ultimate load
M_u	:	design ultimate moment of resistance
M	:	design ultimate moment
M_{face}	:	design ultimate moment at column face
F_{cc}	:	compression force in the concrete
F_{st}	:	tension force in the reinforcement
z	:	lever arm
x	:	depth to neutral axis
b	:	width of section
d	:	effective depth to the tension reinforcement
d'	:	effective depth to the compression reinforcement
c	:	nominal cover to reinforcement
h	:	overall depth of section
K	:	coefficient given by $M/f_{cu}bd^2$
K'	:	coefficient given by $M/f_{cu}bd^2 = 0.156$
A_s	:	area of tension reinforcement
A'_s	:	area of compression reinforcement
p_s	:	earth pressure
υ_c	:	design concrete shear stress

υ_{max}	:	maximum shear stress at column face
$V_{transverse}$	:	design ultimate transverse shear force
$\upsilon_{transverse}$	:	design ultimate transverse shear stress
p_{crit}	:	critical perimeter
$V_{punching}$	:	design ultimate punching shear force
$\upsilon_{punching}$	:	design ultimate punching shear stress

EN 1992:

γ_{mc}	:	partial safety factor of material
γ_c	:	partial safety factor of concrete
γ_s	:	partial safety factor of steel
f_{cu}	:	characteristic compressive cube strength of concrete
f_{ck}	:	characteristic compressive cylinder strength of concrete
f_{cd}	:	design compressive strength of concrete
f_{yk}	:	characteristic yield strength of reinforcement
f_{yd}	:	design yield strength of reinforcement
G_k	:	characteristic permanent action
Q_k	:	characteristic variable action
W	:	design ultimate load
V_{Ed}	:	design ultimate shear force
M_{Rd}	:	design ultimate moment of resistance
M_{Ed}	:	design ultimate moment
M_{face}	:	design ultimate moment at column face
F_{cc}	:	compression force in the concrete
F_{st}	:	tension force in the reinforcement
z	:	lever arm
x	:	depth to neutral axis
b	:	width of section
d	:	effective depth to the tension reinforcement
d_2	:	effective depth to the compression reinforcement
c	:	nominal cover to reinforcement

h	:	overall depth of section
a	:	distance from the periphery of the column to the control perimeter considered
K_0	:	coefficient given by $M_{Ed}/f_{cu}bd^2$
K_0'	:	coefficient given by $M_{Ed}/f_{cu}bd^2 = 0.167$
A_{s1}	:	area of tension reinforcement
A_{s2}	:	area of compression reinforcement
ρ_1	:	reinforcement ratio corresponding to A_{s1}
p_E	:	earth pressure
k	:	a coefficient relating to section depth
v_{min}	:	minimum shear stress
σ_{cp}	:	average compressive stress in concrete due to axial force
N_{Ed}	:	axial force in the cross-section
A_c	:	cross-sectional area of concrete
$\upsilon_{Ed\,(face)}$	:	design shear stress at column face
$\upsilon_{Rd,max}$	:	maximum shear stress, limited by crushing resistance of compression strut
υ	:	strength reduction factor for concrete cracked in shear
α_{cc}	:	a coefficient taking account of sustained compression
$V_{Ed,red\,(transverse)}$	:	design ultimate transverse shear force
$\upsilon_{Ed\,(transverse)}$	:	design ultimate transverse shear stress
u_0	:	length of column periphery
u_1	:	critical perimeter
ΔV_{Ed}	:	net upward force within the control perimeter
$V_{Ed,red\,(punching)}$	:	design ultimate punching shear force
$\upsilon_{Ed\,(punching)}$	:	design ultimate punching shear stress

ACI 318:

f_{cu}	:	characteristic compressive cube strength of concrete
f_c'	:	characteristic compressive strength of concrete
f_y	:	characteristic yield strength of reinforcement